THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

Vol. 65 Thursday, September 18, 1941 No. 1309

PUBLISHED WEEKLY

Subscription Terms (Home and Overseas): 21s. per annum. All Subscriptions are payable in advance.

THE FOUNDRY TRADE JOURNAL
49, Wellington Street, London, W.C.2.
WARTIME ADDRESS
to which all communications should be sent until further notice:—
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Telegraphic Address: "Zacatecas, High Wycombe."
Telephone: HIGH WYCOMBE 1792 (3 lines).

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The New Spirit

Though the representatives attending the meeting held last week of the Joint Council of the Ironfounding Employers' Association were largely the same as those which formed the committee of the Ironfounders' National Confederation before its reorganisation, an entirely new spirit was shown. "Jockeying for position" has been replaced by a genuine desire to co-operate in order that the industry can be assured of adequate service in its negotiations with Government departments. There are men within the foundry industry doing highly skilled jobs, whose designations are not set out in official lists and whose services may be lost to the national effort on this account. To deal with this or similar situations, the individual foundry owner or managing director should address himself forthwith to his association marking his letter: "for submission to the Joint Council." By so doing, there is every chance that his case can be rectified by citation of successful action having been taken elsewhere or its strength reinforced by the receipt of similar instances from other establishments. In every case the background must be—Will the satisfaction of the application be in the genuine interest of the war effort, viewed in its most recent light? We have added "viewed in its most recent light," because the maximum aid we are pledged to give to Russia has, as it was bound to do, modified the policy of Ministry of Supply.

The Joint Council has been strengthened in one material particular, and that is, the foundries attached to engineering works are now represented, whilst its technical strength now reaches a maximum through the invitation it has extended to the Institute of British Foundrymen and the British Cast Iron Research Association to participate in its deliberations. There are but two sectional employers' associations which so far have refrained from participation on the ground of "non-community of interests." This is an entirely false premise, as they cannot know how they will be affected by reorganisation of Government departments, or how future "Orders" will affect them. To base opinions on past experience in this dynamic age is manifestly absurd. Any impartial onlooker at the foundry industry, with justice, would assert that several of the trade associations could and would function better and more economically as committees of a large-scale parent body. By so doing, they would quickly find, as has been found in other industrial countries, that community of interests far outweighed their sectional objectives. All foundries are influenced by changes in railway and other transport rates; are interested in methods of making their sectional interests free from the evil of uneconomic price levels; the legal aspect of consequential damage due to the supply of an alleged faulty casting, and so forth. It is obvious that a focal point for obtaining information covering the widest possible field is desirable, and under present conditions an economic essential. Put bluntly, access to the best possible commercial information is just as important as being technically well informed. Both are accomplished by the same process of co-operative action. Finally, of the new Joint Council, it should be stressed that it will, *inter alia*, function by disseminating in good time annotated information received from official sources through the participating associations to the members, and receiving back through the same channel the reactions to the impacts made upon the individual firms. Action can then be taken in the interests of the community, of the industry, and of its component concerns.

Institution of Mechanical Engineers

A luncheon has been arranged by the Institution of Mechanical Engineers, to be held tomorrow, September 19, at Grosvenor House, Park Lane, London, and this will take the place of the usual annual dinner. Amongst the principal guests will be Mr. John G. Winant, the American Ambassador; Mr. A. V. Alexander, the First Lord of the Admiralty; Lord Hankey, Paymaster-General; Lord Leathers, Minister of War Transport; Sir Dudley Pound, the First Sea Lord; General Sir John Dill, the Chief of the Imperial General Staff; Sir Charles Portal, the Chief of the Air Staff; representatives from the various Government departments and Supply Ministries with which the Institution has been in specially close collaboration since the beginning of the war; Presidents of kindred institutions, etc. The guests will be received by the President, Mr. W. A. Stanier (Chief Mechanical Engineer of the L.M.S. Railway), and Mrs. Stanier, and a record attendance of nearly one thousand members and ladies will be present on this occasion. It has been a great disappointment to the Institution that so many applications had to be refused, but, due to war conditions, it has not been found possible to cater for a larger number.

More War Damage Legislation

TWO NEW ACTS EXPLAINED

Cognisance should be taken of two recent measures concerning war damage, the "War Damage (Extension of Risk Period) Act 1941" and the "Repair of War Damage Act 1941." The former measure really gives power to make compensation payments in respect of war damage under the Buildings Scheme (this applies to buildings and fixed plant and machinery) of the "War Damage Act 1941," which may occur between September 1, 1941, and August 31, 1942, called the "second risk period." No definite contribution is laid down in the Act for this additional cover, and the rate is to be considered by Parliament at some future date. Contributions—2s. in the pound of annual value—for the five years 1941-2-3-4-5, due each July 1, will continue to be made in respect of the "first risk period," *i.e.*, September 3, 1939, to August 31, 1941, as now. The second Act mentioned may be useful to many people in these difficult days as regards obtaining building materials and labour, and amplifies and quickens procedure of the Housing (E.P.) Act 1939, so that a local authority can execute repairs to property war damaged. The cost of this is to remain a charge on the property to be considered at the end of the war. The authority is allowed to act, after a notice has been served on the person having control of the property (*e.g.*, owner, etc.), with a period of grace (not less than 14 days) given for the owner to reply. If the person concerned replies that he is able and willing to do the necessary work, the notice will be withdrawn. Under the former Act the authority was required to be satisfied that the person concerned was not able or willing to do the job before a notice could be served.

If, however, the owner, etc., as may well be the case, welcomes the authority acting, repairs will be started forthwith, that is, before the period of grace expires. But the foregoing notwithstanding, an authority can act forthwith, without any approach to the owner, etc., where urgent repairs are considered necessary to safeguard the property. Ordinarily this Act will not apply to purely factory premises, but it will apply to composite premises used for both residential and business purposes.

Porous-Metal Filter

A porous metal product, called Porex, capable of removing foreign materials from fluid, such as oil, and of altering the characteristics of gases by diffusion is announced by the General Motors Corporation. Manufactured from powdered metal subjected to a series of processing operations, it has certain physical characteristics, such as chemical composition, structure, porosity, strength and ductility, which may be varied within certain limits to accommodate specific applications. Uses for the product are found in almost any appliance or piece of industrial equipment involving the flow of gases or liquids.

This new filter and diffusing material, for example, is used to prevent clogging of orifices in diesel injector nozzles with effective removal of fibrous materials. It also acts effectively in preventing a drying agent from passing from its chamber into a refrigeration system when the refrigerant passes through it to be dried.

A feature of the product is its ability to be bonded to steel and copper. It can be made an integral part of solid metal which may be machined, ground, bored, threaded, or processed for individual requirements. The metal is available in the form of discs, cylinders, and truncated cones. Special shapes also are made.

Some Jobbing Foundry Experiences—XXVI

By "TRAMP"

Jobbing shops cannot always find suitable moulding boxes to accommodate jobs in two-part boxes to mould by the turnover method, and consequently many castings are made either partially or entirely in the foundry floor, with a suitable top box. Such a case is a large cast-iron shaft as Fig. 1. A section of the mould being shown in Fig. 2. This shows the pattern bedded in the foundry floor and a plain shallow top moulding box being used to carry the top. A and B are alternative methods of effecting a good clean "lift" of the top. A is a joint "grid" of cast iron, and is considered a superior method to B, which incorporates a number of hooks or gaggers suspended from the cross bars of the box. The grids A are secured to the top box by four hooks which are wedged in position, and on their being knocked out after pouring, the casting is more easily removed from the mould than from one stayed by method B, especially if dry-sand moulding

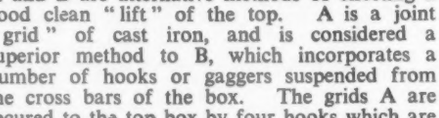

FIG.1.

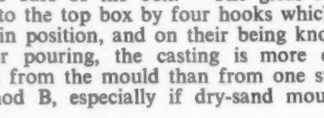

FIG.2.

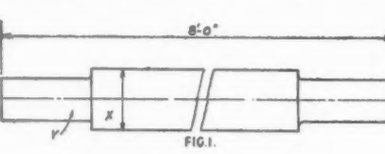

FIG.3.

were practised. Point grids are also useful in cases where middle moulding boxes have to be used for tops, and there are no facilities for staying the mould except by such a medium. The shaft in Fig. 1 was about 8 ft. long and 10 in. in diameter at X, portion Y being square. The casting was poured through the square end and two 1½-in. diameter risers were situated equal distance from each end and each other. These were rod-fed by ½-in. diameter bars. The riser bushes as well as the runner basin were made quite deep to allow adequate metal for feeding the casting. Fig. 3 is a sketch of the runner arrangement; A is the ingate cut in the bottom half, while a spinner or cleaning gate B is cut in the top to ensure good clean metal entering the mould, C being the down gate.

Strain Hardening of Grey Cast Iron

The effect produced on Rockwell hardness of grey cast iron by increasing compressive loads was discussed by J. S. PECK in a Paper presented at the recent Chicago meeting of the A.S.T.M. The data show that up to 40,000 lbs. per sq. in. hardness increases slightly. From 40,000 to 60,000 lbs. per sq. in. no significant change is observed. From 60,000 lbs. per sq. in. to failure the hardness decreases rapidly. To explain this apparent violation of the theory of strain hardening micrographs were made in the same spot in one specimen after the increasing compressive loads had been applied. These micrographs show minute cracks after a load of 60,000 lbs. per sq. in., which cracks increase after succeeding loads until failure. It is concluded that the apparent softening of the metal is due to the penetrator of the tester slipping into one of these minute fissures and giving a lower reading.

Random Shots

The indignation with which the Editor rightly views the request of the Controller of Salvage to deliver up one's accumulations of technical journals for scrap raises an interesting domestic controversy. It appears that the Controller of Salvage is not the first one to suggest such a dastardly measure. Many a foundryman and his wife, best of friends for fifty-one weeks of the year, have quarrelled for the odd remaining week over the disposal of that ever-increasing pile of literature, which "clutters up the spare-room so!" How can a mere controller of salvage hope to succeed where a wife, whom one delights to please, fails miserably year after year?

* * *

Incidentally, many a foundryman, who has been receiving the *F.T.J.* regularly in his own home, has come to listen expectantly for that weekly "plop" with which it is deposited on to the hall floor as the postman shoots it through the letter box. In fact, some wag once remarked that it always reminded him of the cat being drowned in the garden tub with a brick (or even an *F.T.J.*?) tied round its neck.

* * *

Not everyone, however, uses the Journal for drowning the cat with, for "Marksman" well remembers a well-known metallurgist saying that some of the most interesting afternoons he enjoyed on retirement were spent in the attic amongst his collection of FOUNDRY TRADE JOURNALS. In another home to which "Marksman" has the entree, a current copy of the Journal is always at his host's bedside, as if cast iron and marmalade make the best combination of flavours, or maybe the study of the pseudo-martensitic structure of cast iron lulls him into a peaceful and dreamless sleep?

* * *

Mary was on night shift, but her heart was not in her work. One night, the foreman found her machine stopped and her place vacant. The next night the same thing happened. When, on the third night, Mary was once again missing, the foreman decided it was time to remonstrate with her. "I do believe," said he, "that you spend half the night in the blackout with a bunch of lads, they must come ringing their bicycle bells for you night after night." "Indeed they don't," replied Mary, indignantly. "They whistle, when they want me."

* * *

A very precise mother said one day to her daughter: "My dear, your speech is becoming very slovenly. Will you please try to improve it?"

To which the daughter, always ready to humour these fussy elders, replied cheerfully: "Okey, Dokey, Ma!"

* * *

The difference between present and peacetime feeding is that one now chews what one then *es*chewed.

* * *

Notice seen in the cloakroom of a restaurant where no one was in attendance: "Gentlemen take their own hats. Others are asked to do so."

* * *

Another restaurant, large enough to possess several entrances, displayed over each a notice of direction. Three of them read "To the salted almond bar," and the fourth "Grill room. Cooled air." After that "Marksman" has decided it best to feed at the canteen.

"MARKSMAN."

British and American Clays

GENERAL SURVEY OF THEIR OCCURRENCE, COMPOSITION AND PROPERTIES

By FRANK HUDSON

The American Foundrymen's Association Exchange Paper given this year to the Institute of British Foundrymen on American Synthetic Sand Practice, by Norman J. Dunbeck, provides some extremely useful information on bonding clays, a subject which has not received, in this country at any rate, the attention it deserves. The presentation of the above Paper at the present time is opportune in view of the need to reduce imports of such material as bentonite, etc., and for the foundryman to utilise alternative home supplies of bonding materials as far as possible. To supplement Mr. Dunbeck's excellent Paper and to assist the work being done at the present time in this country it is felt that comparative information on the properties of bonding clays in America and here may be of service. About 4 years ago the author prepared some notes upon the subject, which appear to meet this need, and are given in this article.

From the geological point of view clay is classed as a sedimentary rock, and in foundry practice is used extensively in the form of fireclay, boulder clay, etc., and also occurs as an important variable in the bulk of natural moulding sands. The term clay as applied to fireclay or boulder clay deposits does not necessarily constitute material having similar properties to that found in naturally-bonded sands, and in this latter connection it is preferable to apply the terms " bond " or " clay substance."

Apart from " clay substance," the detrital constituents of common clay deposits differ little as regards kinds from those of the sandstones, being only in a state of more minute subdivision. This has rendered their examination a matter of some difficulty, but the following may be regarded as common constituents of clay:—

(1) *Quartz.*—Free quartz is often present in sufficient quantity seriously to decrease the plasticity of clays. As it does not absorb water, however, it decreases the shrinkage which occurs when clays are dried.

(2) *Felspars.*—Felspars are occasionally present in a sufficiently undecomposed state to admit of their identification under the microscope at high magnification. Orthoclase, which is less liable to decomposition than the lime and soda base felspars, is more frequently found than the latter varieties.

(3) *Mica.*—Mica, particularly muscovite, is often found in clays.

(4) *Iron Pyrites.*—This mineral and also marcasite are fairly common in clays and are objectionable. On weathering these sulphides of iron undergo oxidation, with the eventual production of sulphuric acid, which leads to the formation of gypsum and other undesirable minerals. They have also a low melting point.

(5) *Iron Oxides.*—When hydrated exists as limonite giving the clay a yellow or brown colour, and when anhydrous as hematite (Fe_2O_3), it confers a red colour on the clays. Iron is also found in a partially oxidised condition as ferrous oxide (FeO), when it is particularly dangerous, reacting to form relatively fusible silicates.

(6) *Calcite.*—Carbonate of lime in this form results from the action of carbon dioxide, contained in percolating water, upon lime freed by the weathering of plagioclase felspars. Alternatively it may be present as intermixed chalk or shell particles.

(7) *Gypsum (Selenite).*—Hydrated calcium sulphate ($CaSO_4.2H_2O$). Its presence is objectionable.

(8) *Dolomite.*—Certain minerals containing magnesium, such as biotite mica, lead to the production of dolomite or calcium-magnesium carbonate.

(9) *Carbonaceous Matter.*—Organic matter is not uncommon in clays, and is an advantage in the case of those having low fusibility.

Clays can be described as aggregates composed of a variety of mineral fragments ranging in size from sand grains to particles under one micron (0.00004 in.) in diameter. The larger particles being principally composed of quartz, felspar and mica as previously mentioned, whilst the true " clay substance " is contained only in the particles of finest dimensions, probably not exceeding 5 microns (0.0002 in.).

In connection with true " clay substance," recent research has definitely indicated that this is not made up from any one mineral as commonly supposed. Much credit is due to C. S. Ross and P. F. Kerr[1] for the results obtained in this direction, and their investigations show that many of the fine particles in clays represent identifiable minerals. As a class the clay minerals are hydrated silicates of alumina, with or without the alkalis or alkaline earths, having a general composition as shown in Table I. (At the present time it is not possible to give exact formulæ.) Recent work by Grim, Bray and Bradley[2] conducted on the constitution of American bonding clays indicate that kaolinite, beidellite, montmorillonite and a mineral resembling the sericite form of white mica are the most common clay minerals, and the properties of the clay are different according to the type of minerals present. For example, clays composed primarily of beidellite or montmorillonite have higher green-bond strength, and possibly better durability characteristics than those composed of the other clay minerals. This is of particular interest in modern foundry practice, and the tendency for synthetic sand production using bentonite, as this clay contains a high percentage of montmorillonite.

TABLE I.—*The Clay Minerals (Grim, Bray and Bradley).*

Name.	Chemical composition.	Remarks.
Kaolinite ..	$Al_2O_3.2SiO_2.2H_2O$	Anauxite and kaolinite form an isomorphous series.
Anauxite ..	$Al_2O_3.3SiO_2.2H_2O$	—
Halloysite	$Al_2O_3.2SiO_2.xH_2O$	—
Beidellite	$Al_2O_3.3SiO_2.xH_2O$	Beidellite and nontronite form an isomorphous series.
Nontronite	$Fe_2O_3.3SiO_2.xH_2O$	
Montmorillonite	$Al_2O_3.4SiO_2.H_2O$	Montmorillonite, beidellite, and nontronite probably contain essential alkalis or alkaline earths.
Sericite-like Mineral ..	$K_2O.3MO.6R_2O_3$ $18SiO_2.5–10\ H_2O$	— —

So far as clay substance is concerned, it should be very definitely recognised that whilst much additional research is required for a complete understanding of all the factors involved, sufficient evidence has been obtained to indicate the real importance of the mineral composition of the material and the need of further work in this direction from both foundry and geological aspects. In this latter connection Ries[4] draws attention to the fact that whilst one is apt to think of the clay minerals as products of weathering, wider observation has shown that some of them may originate by hydrothermal action or even under marine environment.

Little work has been conducted in this direction on British clays with the possible exception of that conducted in 1914 by Mellor[4] on certain fireclays which were found to belong to the kaolinitic type.

The distinctive property of clay is its plasticity, and most of its uses depend upon this property and upon the fact that it is entirely lost when the material is heated to a certain temperature, when it acquires rigidity of form. The reasons for this property of plasticity are as yet incompletely understood but are probably due to several factors connected with particle size and the presence of colloidal matter. A satisfactory definition of " colloids " is too technical and comprehensive to be desirable here and the reader is referred for further information to the work of Ries.[5] In a valuable summary upon the theories put forward to explain plasticity the above authority refers to that based on molecular attraction which, where such small bodies are in question, may not unreasonably be supposed to exercise some effect in holding the particles together while still allowing them to slide round one another. Thus it will be seen that electro-chemistry plays an important part in the matter and a full review of the factors have been recently outlined by Clews.[6] Since the action is partly an electro-chemical function it follows that the presence of salts and other materials in the water have a profound effect, particularly when the water is in excess of the clay as in suspensions and emulsions such as might be employed in refractory mould washes. The impurities in the sand or clay play an important part in this reaction and it was shown in 1879 by Senfft[7] that the absorptive power of clay increases with the limonite content ($2Fe_2O_3.3H_2O$).

The water present in clay and clay-bonded materials exists in two ways. A certain amount is absorbed by the clay " cells " and is termed combined or " miscellian " water as distinct from the free moisture present which can be removed on drying at 110 deg. C. On heating above about 400 deg. C. clay begins to lose its combined water, becomes " dead " and cannot usually be retempered. The temperature at which combined water is removed, and the amount, varies with different clays according to their structure and composition. For example, a clay composed entirely of the mineral montmorillonite would contain approximately 20 per cent. combined water, whilst kaolinite contains 13.9 per cent. Montmorillonite is dehydrated gradually up to about 550 deg. C., at which temperature crystallographic changes begin. Kaolinite loses its water between 400 and 510 deg. C., whilst the hydrated ferric oxides, collectively designated as limonitic material, lose practically all their moisture below about 200 deg. C. These observations are extremely valuable when considering the durability of moulding sands and it would appear that latest evidence does not support the suggestions often put forward in the past relative to the longevity of certain sands having a bond made up from limonitic material.

On heating clays above 1,060 deg. C. the mineral mullite ($3Al_2O_3.2SiO_2$) is formed, together with one of the high temperature forms of quartz. The exact changes taking place are still unknown and it is highly possible that

British and American Clays

other reactions occur as well. The minerals formed, however, by the effects of high temperature possess none of the properties of the original clay and from the foundry point of view would remain in the moulding sand and increase the quantity of silt.

So far as moulding sands are concerned, their refractoriness appears to be determined by the fusing point of the clay bond. Skerl[4] has shown that the fusing point of the bonding material in a representative selection of British moulding sands varied from 1,270 to over 1,400 deg. C. and even the higher temperature is well below the fusing point exhibited by the sands as a whole. The same investigator also suggests that the refractoriness of the clay grade is governed by the percentages of silica (SiO_2) and alumina (Al_2O_3), and shows that an increase in the ratio of alumina to silica results in a higher fusion point of the clay grade. This confirms the work of others in connection with fireclays.

General chemical analysis of sand and clays is not now accepted as a satisfactory method of evaluation and accordingly it is not proposed to discuss this aspect in any detail, although typical results will be given from time to time in the text as a matter of interest.

Typical deposits of clay of interest in foundry practice, apart from that associated with naturally-bonded moulding sands, can be outlined as follows:—

Boulder and Surface Clays

These as a whole vary enormously in character according to their origin and mode of deposition. They are principally used in foundry practice for the manufacture of "clay water" for use in black wash for coating mould surfaces. They are low in refractoriness and, apart from the above service, should not be used as an extensive addition to moulding sands although the fusing point is fairly satisfactory in the presence of excess carbonaceous matter such as exists in mould washes. For best practice their use is not recommended, as more uniform and consistent bonds are available. A typical analysis of boulder clay is given in Table II.

Alluvial and Ball Clays

These are used extensively for the manufacture of domestic and industrial earthenware and some deposits are capable of service as a bond in moulding sands when maximum refractoriness is not a principal consideration. The Devon blue-ball clay deposits at Newton Abbot are possibly one of the best sources of this type of material in Great Britain but difficulty arises in obtaining satisfactory sand mixtures unless the clay is added in a dry pulverised state or, alternatively, in the form of a slurry.

China Clay (Kaolin)

China clay is a white material of low plasticity found in large quantities in Cornwall and Devonshire, Canada, Australia, the U.S.A., South Africa, and elsewhere. As the name implies, one of its chief uses is in the manufacture of pottery, although in modern times large quantities are used as a "filler" in paper making and for the sizing of textile fabrics as well as in many other branches of industry. The term kaolin refers to any clays having the general characteristics of china clay, quite independently of their origin, so that unless care is taken confusion may easily arise. China clay, as mined in Cornwall and Devonshire on a large scale, conforms nearly to the composition $Al_2O_3,2SiO_2,2H_2O$ and is chiefly formed by the disintegration of pegmatite—a kind of granite.

So far as foundry practice is concerned, china clay has been used for certain applications, although not extensively. It makes an excellent bond for refractory washes where high heat-resistance is desired, as, when pure, it has a softening point around 1,750 deg. C., but its low plasticity prevents it being used for many purposes for which the somewhat less pure, but more plastic, clays are in demand. It contains on an average about 42 per cent. alumina, 40 per cent. silica, with water and minor impurities (mainly iron) as shown in Table II. So far as composition is concerned, a carefully selected and refined china clay approaches more nearly to a pure clay than any other known.

TABLE II.—*Analysis of Various Clays.*

	SiO_2	Al_2O_3	Fe_2O_3	FeO	Na_2O	K_2O	CaO	MgO	TiO_2	Loss on ignition.	Fusing point, deg. C.
Surface boulder clay (British)	50.48	24.23	8.96	—	2.77	2.77	2.15	2.28	—	9.25	—
„ „ „ (U.S.A.)	66.08	17.50	8.00	—	1.22	1.22	1.00	1.58	—	4.62	1,310
Devon blue-ball clay (English China Clay Sales Co., Ltd.)	51.51	33.90	1.00	—	0.68	0.82	0.58	0.26	1.25	9.80	—
China clay (English China Clay Sales Co., Ltd.)	46.86	38.75	0.37	—	0.10	0.56	0.46	0.05	0.01	13.00	—
Colloidal kaolin (Stockalite, English China Clay Sales Co., Ltd.)	46.25	39.15	0.64	—	—	—	0.20	Trace	—	13.76	—
Wyoming bentonite (American Colloid Co., U.S.A.)	64.60	20.80	3.05	0.46	2.60	0.40	0.53	2.30	0.15	4.74	1,340
Colbond (Colbond, Ltd., London)	61.57	18.56	3.08	—	0.65	0.65	1.07	0.62	0.96	13.41	1,490
Fireclay (Lower Kittanning, Ohio, U.S.A.)	58.45	26.95	1.58	—	2.76	2.76	0.30	0.49	0.47	8.80	1,650
„ (Kentucky, U.S.A.)	46.16	35.04	1.42	—	0.64	0.64	0.27	0.49	2.44	14.40	1,720
„ (Bollington, Lancs)	65.77	18.11	0.72	2.34	0.36	2.64	0.14	1.35	1.05	7.32	1,380
„ (Bonnybridge, Scotland)	47.95	32.74	1.22	0.75	0.10	0.97	0.28	0.61	1.51	14.02	Over 1,670
„ (Stourbridge, Staffs)	45.22	31.32	1.76	—	0.23	0.94	0.34	0.51	1.08	18.52	1,760

TABLE III.—*Particle Size of Clay Materials.*

Source.	Per cent. particle size of clay materials.		
	Larger than 20 microns.	Between 2 and 20 microns.	Under 2 microns.
Wyoming bentonite	5	8	87
Finest ball clays	0 to 10	5 to 33	40 to 80
China clay (finest paper grades)	0 to 44	30 to 55	10 to 70
Fireclay (typical U.S. high plastic)	30	37	33
Passing 270 mesh substance extracted from Albany moulding sand	70	15	15

Bentonite, etc.

Bentonite is a natural clay-like substance, originally discovered in Wyoming (U.S.A.) and named from its occurrence in the Fort Benton series of rocks. The material occurs in various forms throughout the world, having been reported in Canada, China and even Cumberland, but the bulk of commercial quantities at present available centre in the United States. Bentonite is of particular interest to the modern foundryman as a bond for synthetic moulding sands and mould washes. In recent years the name has been made to cover a range of materials so-called because they were formed under similar geological conditions or are mineralogically similar. It should be appreciated, however, that from the foundry point of view, all grades of "bentonitic" clays do not behave in the same way, and from tests conducted by the author, it would seem that the original Wyoming bentonite is at the present most satisfactory for general purposes, and the properties about to be described refer to this source.

Wyoming bentonite is composed chiefly (70 to 80 per cent.) of the clay-mineral montmorillonite, together with felspars (albite and oligoclase), and smaller amounts of calcite, quartz, volcanic glass, mica (biotite), gypsum, zeolite, and having an average analysis as shown in Table II. It occurs in beds from 2 to 4 ft. thick, usually holding 30 to 45 per cent. water, even in well-drained areas, and has to be dried down to 9 per cent. moisture and then powdered for commercial use, and is thought to have been formed through the decomposition of glassy ash of volcanic origin laid down thousands of years ago in Upper Cretaceous times. Probably one of the most interesting points about the material is the minute state of sub-division of its clay substance particles, as 65 to 70 per cent. are of colloidal dimensions, being under 0.2 micron (one micron is about 1/25,000 in.), and this is probably a much larger proportion of colloidal matter than possessed by the finest ball clays and kaolins. Indirect tests tend to point to the particles having a lamellar shape comparable with that of mica. The data in Table III, submitted by the American Colloid Company, are of interest in this direction:—

This accounts for its remarkable affinity for water absorbing 5 to 6 times its weight and swelling from 14 to 16 times its dry bulk. In 25 parts of water 90 per cent. of the bentonite remains in suspension indefinitely. These properties are unimpaired on drying up to 232 deg. C., they then begin to diminish but are not completely destroyed until a temperature of about 650 deg. C. is reached. The presence of an active alkali (such as Portland cement) exceeding 10 per cent. of the weight of bentonite will prevent retempering after heating. Other properties of bentonite are as follow:—

Specific gravity	2.79
Weight (pulverised)	60 lbs. per cub. ft.
Refractive index	1.53 to 1.56
Fusion temperature	1,340 deg. C.

The viscosity, suspending and bond-forming properties are greatly increased by the addition of 0.5 to 2.5 per cent. magnesium oxide

British and American Clays

but sodium chloride and certain other soluble salts act in the reverse direction.

Kerr[9] points out that mineralogical text-books of the 18th century described a clay mineral known as smectite, which was regarded to be a prominent constituent of fuller's earth. Since it now appears that smectite and montmorillonite are identical, it has been suggested that the clays now called fuller's earth could be renamed and be mineralogically designated as bentonite. If this be correct, it would be of considerable interest to have a comparison with bentonite of the British fuller's earth deposits in Surrey, Kent and Bedfordshire.

At present the only home-mined colloidal clay which can be used instead of bentonite is that marketed under the name of Colbond. This has a similar chemical analysis as shown by Table II, but it is not so plastic nor does it absorb so much water. Actual tests in this connection conducted by the author indicate that for increasing the bond strength of moulding sands about double the quantity of Colbond is required over the best bentonite to obtain a certain strength figure. Tests conducted by Sheehan,[10] on the other hand, showed that the green-bond strength of bentonite and Colbond were in the ratio of 5:3. The fusion point of the latter material is higher than bentonite, being between 1,480 and 1,500 deg. C.

Fireclays

As the name implies, these are clays which have a notable resistance to heat and it is not customary to include materials under this term unless they have a fusing temperature above 1,580 deg. C. Fireclays are usually associated with the Coal Measures and are found in seams or beds varying from a few inches to about 5 ft. in thickness and as mined are in the form of irregularly shaped lumps of various sizes. Some of the best refractory clays are underclays of coal seams but it by no means follows that all fireclays are found in this position as, for example, the "pocket clays" of Derbyshire and Staffordshire. Typical chemical analyses of British and American fireclays are given in Table II. The majority of the British materials are of the siliceous type, *i.e.*, they contain more silica than is required to form kaolinite with the alumina present. The percentage of silica varies from about 45 to 80, the clay then passing with further increase of silica into a quartzose rock, which when mixed with clay often assumes the well-known material ganister. On the whole, the Scottish clays are decidedly less siliceous than the English or Welsh. No British fireclays have a refractoriness greater than 1,770 deg. C. and most of them are around 1,670 to 1,710 deg. C., although some have only a fusing point of around 1,580 deg. C. or less. The specific gravity is about 2.6.

The addition of fireclay to moulding sands is not uncommon in some districts, particularly for the founding of steel castings.

In Ennos and Scott's[11] report on the fireclay resources of Great Britain, the general survey of the chemical analyses and refractory tests gives the following important conclusions:—

(1) The greater the ratio of alumina to silica and the greater the percentage of combined water, the higher is the refractory quality of the clay.

(2) Basic oxides, such as ferrous oxide, lime, magnesia and alkalis, lower the refractoriness, but their influence as fluxes does not appear to be nearly so marked as that of silica.

(3) It is impossible, taking the whole series of fireclays, to find any relation between the refractoriness and the basic oxide fluxes, since the influence of the latter is often completely masked by the effect due to varying silica. Only when comparing clays of similar alumina and silica content is the effect of basic oxide fluxes apparent.

(4) With one exception, all the fireclays investigated which contain less than 50 per cent. silica, over 30 per cent. alumina, and more than 8 per cent. of combined water, soften at or above 1,670 deg. C. The amount of basic flux present in these highly refractory clays may vary within limits, but where the percentage of silica is comparatively low (48 per cent.), the total of lime, magnesia and alkalis may be as high as 5.8 per cent. This does not preclude the existence of good refractory fireclays with less alumina and more

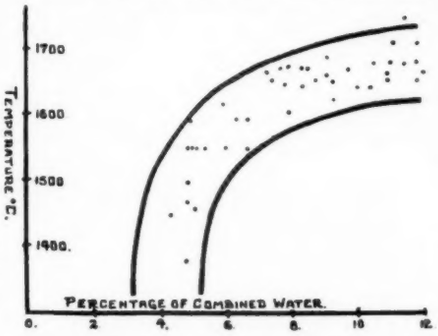

FIG. 1.—DIAGRAM SHOWING THE RELATION BETWEEN THE COMBINED WATER AND FUSION POINT OF FIRECLAYS. (ENNOS AND SCOTT.)

silica (50 to 60 per cent.), but then much depends on the amount and nature of the alumina and basic fluxes present.

(5) When the percentage of silica rises to between 60 and 80 per cent., with a corresponding fall in the alumina, the fireclay softens below 1,670 deg. C., even though the amount of basic oxide flux is comparatively small.

(6) The amount of alkali which a high-grade fireclay can carry seems to depend on the silica and alumina content, as shown below:—

Per cent. SiO_2.	Per cent. Al_2O_3.	Per cent. total alkalies (K_2O and Na_2O).	Softening point, deg. C.
57.4	26.4	2.60	1,670 to 1,690
53.3	28.0	3.20	1,670 to 1,690
47.9	30.05	3.99	1,670 to 1,690
47.5	33.1	4.5	1,670 to 1,690

(7) There is very little concordance between refractoriness and chemical composition in fireclays of lower quality, and it is not generally possible to grade these by means of chemical analysis with any degree of accuracy. Probably the simplest and most useful chemical method of estimating the refractoriness of fireclays is to determine the combined water. This constituent increases with rise in refractoriness, and it may be easily and rapidly determined on a sample of clay, no chemical separations being involved in the process.

With some exceptions the rule appears to hold that for clays with combined water greater than 9 per cent. the cone value to combined water ratio is very nearly three. When the combined water is between 7 and 9 per cent. the ratio approximates to 3.5; while for combined water less than 7 per cent. the ratio rises to four or more. This relationship is quite empirical and far from accurate, but it gives the quickest chemical means of distinguishing between good and bad clays.

Fig. 1 reproduces a diagram from Ennos and Scott's work showing the relation between the combined water and softening point of fireclays.

These results should be of considerable future value for assessing the quality of clay bonding materials, particularly those used for synthetic sand production, and they may quite possibly be adapted to the study of naturally bonded moulding sands in general.

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Outdoor Illumination in Black-Out

The BS/ARP16 specification issued in September, 1939, which dealt with methods of providing low values of illumination for outdoor use during the black-out, was based solely on a maximum of 0.002 foot-candle with a minimum spacing-mounting height ratio of 4:1. The revised issue (dated February, 1941) of BS/ARP16, whilst retaining the same value of illumination and the 4:1 minimum spacing-mounting height ratio for lamps and fittings now introduces details of fittings for a 2:1 spacing-height ratio. New fittings to comply with these regulations have recently been announced by The General Electric Company, Limited. Type F.17029 fitting is of the standard pattern and 1¼-in. mounting hole, and type F.17030 is weatherproof.

These 2:1 spacing electrical fittings are designed for three mounting heights, namely: 10, 15 and 20 ft. The necessary variation in the distribution of light is governed by the use of various translucent and/or perforated screens. Thus, with a mounting height of 10 ft. the masking would consist of one opal screen and a black perforated sheet; at a mounting height of 15 ft., two opal screens would be used; and at a 20-ft. mounting height, only one opal screen is specified. This fitting will be stocked each with a complete set of screens, and each fitting clearly marked with the screen combinations to be used with the various mounting heights.

Belgian Industrial Production

Last year coal production in Belgium averaged 2,133,000 metric tons per month, against 2,487,000 tons in 1939. The dislocation due to the invasion reduced output to 665,000 tons in July, after which there was a rapid recovery to 1,502,000 tons in August and 2,539,000 tons in October. The last two months of the year again showed a slight recession. Output in January last was 2,410,000 tons. Coal stocks which reached the record low level of 677,000 tons in May, expanded to 2,325,000 tons, more than one month's output, by October, and closed the year with 1,828,000 tons. Stocks are now slowly declining again with expansion in industrial activity. Production of pig-iron and ferro-alloys averaged 149,000 tons per month last year, against 256,000 tons in 1939, the rate of output at the end of the year being less than half the monthly average of the first four months of the year. Steel production made the same unsatisfactory showing, averaging 158,000 tons per month over the year, against 259,000 tons in 1939. In December the output of steel ingots was 147,000 tons. Last January, metallurgical output included 126,000 tons of pig-iron and 139,000 tons of steel ingots.

D

Foundry Lighting*

IMPACT OF NEW REGULATIONS

Few foundries in the country can be unaffected by the Factories (Standards of Lighting) Regulations which came into force in February this year, and which require certain standards of lighting for all factories working regularly more than 48 hrs. per week, or in shifts. These Regulations have not been made to add one more complication to foundry management, but with a very real background of research, and a desire to improve working conditions. The most striking clauses in these Regulations are the ones which require a *minimum* of 6 foot-candles illumination at a level of 3 ft. above the floor, without prejudice to the provision of any additional illumination required to render the lighting sufficient and suitable for the nature of the work.†

Generally speaking, foundry work is of such a nature that illumination values very much in excess of 6 foot-candles are not necessary; from 6 to 10 foot-candles in fact is recommended for all general processes except fine moulding and core working, for which from 10 to 15 foot-candles is required. These recommendations are based on the amount of illumination necessary to enable operatives to see the job they have to do with reasonable clarity, due consideration being given to the probable cost of such lighting. Obviously, real unobstructed daylight, such as that received out-of-doors, would be desirable if it were obtainable; as it is not, the industry has to do the best it can at a cost which can be justified, and as the cost of light decreases, so it is reasonable to recommend more light for foundry work, not only to improve seeing conditions, but also to provide those cheerful surroundings under which the best work is done, but which are noticeably lacking in many foundries to-day.

Maintenance

Not nearly enough attention has been paid in the past to the adequate maintenance of lighting equipment. Even almost invisible fluff and dust on lamps and fittings may easily account for loss of light of 30 per cent.; what then will be the loss after a few weeks in a foundry with its smoky atmosphere? A recent Government Report mentions cases in which a loss of 41 per cent. was caused solely by removable dirt, so that nearly half the electric current bought and paid for was wasted, and the workmen had only about half the light they should have had. Now that minimum illumination values are obligatory, any foundry in which such conditions are permitted to exist must be prepared to put in an installation originally providing far more than this minimum. The cost of regular cleaning—admittedly an awkward job in many foundries—should therefore be balanced against the loss incurred by neglect of this important measure, and if this is done it is certain that a regular and frequent maintenance schedule will be put in operation.

Fluorescent Lamps

Since foundry executives were among the first industrialists to recognise the value of electric discharge lamps of the now familiar mercury and sodium types, they will probably be interested in the latest type of light source. Fluorescent tubular lamps, utilising a mercury discharge, give a light which is a very close approximation indeed to natural daylight at a far higher efficiency than any former source of light of comparable colour quality. In fact, they give nearly 2½ times as much light as ordinary filament lamps of equivalent wattage, and in spite of the auxiliary gear which they require (as do other types of discharge lamps) they may thus very likely be a sound proposition on cost alone, not taking into account their colour, lack of shadow and glare, and other characteristics which may make them the obvious choice. Installations of these lamps have recently been put into permanently blacked-out foundries, in which the lamps were placed behind diffusing glass screens in positions normally occupied by the windows of a north-light roof, the result being almost identical with peacetime daylight. The economics of such a scheme will obviously vary with local conditions, but there is no doubt that lighting giving this effect stimulates operatives to give of their best. Those within reach of the Lighting Service Bureau at 2, Savoy Hill, W.C.2, would do well to pay it a visit and see for themselves the merits of these lamps in their various applications.

GENERAL OVERHEAD LIGHTING BY ELECTRIC DISCHARGE LAMPS SUPPLEMENTED BY SIDE LIGHTING FROM FILAMENT LAMPS IN ORDER TO LIGHT VERTICAL SURFACES AND REDUCE SHADOWS.

Accidents

It is common knowledge that since the beginning of the war industrial accidents have become very much more frequent. This is no doubt partly due to the extra pressure of work, but two important contributory causes must be, firstly, the black-out (which has so often been unjustly blamed for poor interior lighting) and, secondly, the influx of fresh and unskilled labour. The black-out should have no effect on interior artificial lighting, except perhaps to increase it to compensate for a lack of natural daylight. Difficulties have arisen in making an effective black-out with effective interior lighting, it is true, but we have now had two years in which to overcome them, and that should surely be sufficient. Newcomers to industry are not so aware of the risks attached to their work as their experienced fellows. They cannot appreciate danger unless they can see what causes it, and in dim surroundings their instinct of awareness is only half aroused.

National Industrial Electric Lighting Service

If alteration to the lighting installation is necessary there is no time to lose. Later on the lights will be needed during day shifts to a much greater extent than now, and work done on the installation then is sure to hinder production to some extent. Some executives, however, who do not regularly employ any particular individual or firm to carry out such work, may have little idea how to set about getting any alterations carried out. For them, there has come into being the National Industrial Electric Lighting Service which will, on application, arrange for a qualified illuminating engineer to visit the factory, survey the premises from the lighting point of view, and if necessary prepare a plan showing what improvements are necessary. This service will be given free and without obligation. On receipt of the plan, it is for the executive to get the necessary work carried out by a contractor of his choice, or, if he prefers, to apply to the Service to appoint one. This Service is organised partly to enable industrialists to obtain competent advice and assistance, and partly to enable the relatively small number of qualified illuminating engineers in the country to carry out the large volume of work which falls to them without unnecessary duplication of effort.

High Blast Temperatures

To determine the conditions under which the best practical use is made of high blast-temperatures in the blast furnace, A. D. GOTLIB has made a series of statistical investigations with temperatures from 400 to 860 deg., according to a Paper in "Teori. prakt. met." Under favourable conditions with low-Si iron, a 4 to 6 per cent. economy in coke can be achieved per 100 deg. rise in blast temperature in a temperature range of 900 deg. and over. This may be adversely affected by the bad state of the furnace, the use of excessive ore fines, bad quality coke and unsatisfactory slag composition. Good results can only be obtained if the gas stream through the furnace is carefully regulated.

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* Specially contributed by the E.L.M.A. Lighting Service Bureau.

† In certain cases, as where the mounting height of the fittings necessarily exceeds 25-ft. from the floor, this requirement is modified. Executives are strongly urged to obtain a copy of the Regulations from H.M. Stationery Office, price 1d., or from any bookseller.

Planning Research in Foundry Work*

By DR. J. K. MARAIS

In his introductory remarks to this Paper the author emphasised that it should be regarded as constituting merely a preamble to a more complete Paper which he hoped to present at a subsequent date, when certain experiments now temporarily interrupted had been brought to finality.

Physical, chemical or metallurgical analysis is comparatively simple where it is possible to analyse and investigate one property at a time. As the number of different reactions increase, analysis becomes more involved. For this reason practical research on foundry work could be divided into two categories:—

(1) Physical, chemical and metallurgical analysis of the various materials used in foundry work, such as composition of metals, characteristics of moulding sands, drying processes, etc.

(2) The applicational research by which the results of the investigations mentioned in (1) are translated into actual moulding and casting technique.

The usual way of conducting research work of a highly technical nature is to study one small phase of a phenomenon at a time. This is not directly possible in foundry problems. For this reason very little co-ordinating research work has been done in foundry problems. In most other branches of technology, operations and processes are in series, whereas in foundry work processes and operations converge to a parallel final operation—the actual casting. To illustrate this statement, compare the production of a machined element with the production of a cast element.

The actual manufacture by machining takes place comparatively slowly, a little at a time. The process can very often be stopped at any moment. Inter-process inspection and testing are possible. Mistakes made in one operation can very often be corrected in a subsequent operation. Briefly, manufacture by machining takes place by means of a series of events which are chronologically disconnected, thereby making it possible to experiment and investigate each event on its own. By this method the number of variables affecting the final result, although large in number, can be studied separately, or a few at a time.

In foundry work the position is entirely different. Here a great number of variables enter into the final operation simultaneously or practically simultaneously. This makes it almost impossible to study each variable on its own. Disconnected research on isolated properties of foundry materials only becomes of value when the practical interpretation of results is established by actual practical investigation and analysis of final results.

Therefore, from the nature of foundry work it must be deduced that the most fertile avenue of research will be investigations which culminate in the final casting process in which all possible variables are taken into consideration. The logical procedure is to adopt a process of elimination, although the practical method has been reduced to scientific guess work and practical experience. The chief difficulty in foundry work is that the final results are functions of too many variables, and a diagram showing the main direct and indirect variable factors influencing the results of a cast is set out in Fig. 1.

The degrees in which the control of the above-mentioned factors are in the hands of the moulder depend on the size of the foundry and the organisation of supervisional control. As the size of the foundry increases and depending on the degree of mechanisation, the control of more and more of these factors is taken over by specialists. For example, the selection of moulding and core sands, their mixing and preparation form a specialised work which is gradually being taken away from the moulder and handed over to a separate department. The same applies to the metal used in casting. Such factors as cooling, skimming, rate of pouring, casting temperature, feeding, chills, facing, venting, reinforcement and support, hardness of ramming, shape, runners and risers, still fall under the control of the moulder and the shop foreman. Where moulding machines are introduced, some additional control is transferred to the machine.

* A paper read before the South African Branch of the Institute of British Foundrymen at a meeting on May 29, 1941.

Moulding Materials

In planning research on moulding practice the first factor to be considered is the moulding materials. In South Africa very little has been done in this connection. The reason why so little has been made public of the results obtained on investigations into moulding materials, is because results obtained at one foundry where local sand is used cannot be of direct applicational value at another foundry where the local supply of foundry sand is of a totally different character. Also because the bases on which sands are selected and prepared differ widely. A few foundries are equipped with proper sand testing apparatus. Whether this apparatus is used to the full extent is still doubtful.

If, instead of giving a formula for a sand mixture by stating that so much floor sand plus so much red sand and so much white sand are to be mixed, it would be of far more general importance if certain properties are referred to, as for example: Green strength permeability, moisture content, firmness, etc. Results could then be expressed in international standards which will be of greater value.

The investigation of a few factors will be discussed in more detail. Discussion, criticism and suggestions to plan this type of investigation so as to be of more practical national importance and assistance in solving some problems are invited.

Mould Drying

The technique of drying moulds and cores has an important bearing on the final results obtained in foundry work and economics. Economics is mentioned as a fair proportion of the capital invested in foundry equipment is represented by drying equipment. The time of drying not only affects total throughput of a given oven, but leaves its mark on the fuel bill. Various fuels are in regular use. Their relative merits are not too well understood by most foundrymen, although practical experience has taught them some of the important characteristics to be avoided.

The following fuels are in common use in various countries of the industrial world: (1) Coal (*a*) long flame bituminous and (*b*) anthracite; (2) coke; (3) wood; (4) producer gas from coal and coke; (5) coke oven gas; and (6) blast furnace gas. The properties of these fuels are given in Table I. The drying of cores and moulds does not lend itself to mathematical analysis. Data regarding drying time are very scanty and although the exact drying time for any particular mould or core in any particular oven could be determined very easily by experiment, this type of investigation does not supply all the necessary information required for the design of efficient and economic drying ovens.

In order to plan a series of experiments which will furnish information on the drying of moulding sands as well as design data for drying ovens, certain suggestions are put forward which with the criticism and advice of those present might be used as a basis of investigation.

The factors influencing the drying time of moulds and cores can be summed up as follows:—

The Mould.—(*a*) Moisture in moulding sand; (*b*) thickness of sand in mould; (*c*) area of exposed mould surface; and (*d*) thermal conductivity of moulding sand.

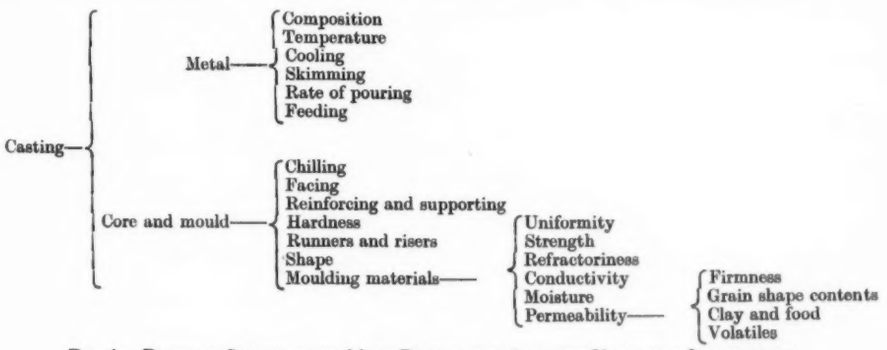

FIG. 1.—DIAGRAM SHOWING THE MAIN DIRECT AND INDIRECT VARIABLES INFLUENCING THE RESULT OF A CAST.

The Drying Gases.—(*a*) Temperature of gases; (*b*) degree of saturation of the gases; and (*c*) gas velocity and turbulence in drying oven atmosphere.

The apparatus set up for investigating some of these variables was given and discussed. The outcome of tests carried out on the lines discussed will be read as a Paper at some future date.

DISCUSSION

The PRESIDENT (Mr. W. J. Petersen), opening the discussion, expressed the appreciation of the meeting, and hoped that at a later date they would have an opportunity of hearing the fuller Paper.

In view of the importance attached to the drying of cores, Dr. Marais was asked to explain what action took place in green-sand castings. DR. MARAIS admitted that it was a subject on which he could only theorise, but by showing the scantiness of their knowledge, theorising should stimulate an interest in practical investigation. Illustrating his explanation by diagrams, he pointed out that in green-sand castings the presence of a certain amount of water lent an artificial permeability to the mould which was not encountered in dry sand. He added that, as water has the highest specific heat of all known substances, the steam generated in the damp sand near the casting is condensed and cooled by the moisture in the sand farther in the mould. This considerably reduces the

Research in Foundry Work

volume of gas to be vented, and gives an artificial permeability to the mould.

The pressure set up by the generation of gas and steam in the mould a short distance away from the face of the casting makes the tensile strength of the moulding material play quite an important part. This is not yet fully understood and will require investigation, especially in connection with scale formation.

Moisture Content

MR. CARTWRIGHT congratulated Dr. Marais on his Paper, which opened up a very wide field for future study. An interesting point had been made in connection with the large number of experiments conducted on cores which, after drying, were allowed to stand. Since moisture always travelled from the centre, the cores in the experiment would have to remain constant in weight for a considerable period after drying took place. Was this the case?

DR. MARAIS stated in reply that if the moisture balance on the outside was kept the same, "flattening out" of the moisture curve was eventually obtained, but in ordinary practice a downward bend always resulted near the exposed face owing to the escape of a certain amount of moisture.

MR. CARTWRIGHT then asked whether there was any marked difference in the water depending on the permeability of the sand, or whether the travelling of moisture was "contagious." In other words, did moisture travel from one particle to another?

DR. MARAIS replied that moisture spread mainly in the open spaces between the particles due to diffusion and capillary action. This could be determined very accurately by experiment.

MR. TONGE said that, in drying a mould, he could assume from his practical knowledge that the main concern was to dry the core sufficiently to prevent reaction taking place until the metal had set, after which neither diffusion nor permeability could cause very much damage to the casting. Though raising this practical point, he was very grateful to Dr. Marais for his experiments, and suggested that individual members could do something in their own works that would help him in the production of a more practical Paper at a future date. Some very successful castings had been made, and this was a step towards what Dr. Marais visualised.

A further point raised by MR. CARTWRIGHT was that the general custom in foundries was to have a constant heat and vary the drying times rather than to dry the moulds for a constant period and vary the heats. His own experience was that a temperature of 250 deg. C. was satisfactory, but in some cases 300 deg. C., or even 350 deg. C., would not be too high if the temperature was raised slowly.

MR. TONGE agreed that an increase in temperature seemed desirable, but emphasised that foundries were invariably working against time and consequently there was always danger of cracking the moulds and disturbing the surface.

Effects of Ramming

Replying to Mr. Holdsworth, DR. MARAIS said that he had carried out a few tests on ramming. By increasing the amount of ramming-force, hardness could definitely be increased. A greater number of light strokes secured a more uniform hardness throughout the core. His tests had been carried out on various mixtures of floor sands, red sands and green sands, and both natural and artificial binders had been used. He had not used oil sands because of the difficulties involved in handling.

Asked whether the binding compounds volatilised completely, DR. MARAIS stated that there were two types of binding agents and that the clay or colloidal type and the oil type reacted differently. In the case of the former very little gas was driven off.

MR. WARD inquired whether Dr. Marais had carried out tests on cores made with various artificial binders. He had often heard that cores made with these binders after a long period of storage had to be redried. Had the moisture actually come from outside, due to absorption by the bond? Alternately, was the time factor responsible? It was possible that dampness attributed to atmospheric moisture was due in many cases to the fact that the mould had been improperly dried initially.

DR. MARAIS said that his results had been obtained mainly with clay binders, and that he had not yet completely investigated artificial binders. There was a possibility that a hygroscopic type of binder might draw a certain amount of moisture from the air.

Natural Binders

MR. CARTWRIGHT wondered whether the problem should not be tackled from the point of view of natural binders. He had often seen moulders trying to get a better result by using more red and less yellow. Yet a fortnight later they would go back to their original mixture, and very much the same results would be obtained.

DR. MARAIS said that in determining the clay content of a used red sand indication of the existence of two different types of clays were found. On shaking up the sand with a caustic soda solution, the clay was brought into suspension. As the amount of caustic soda in the solution is reduced by syphoning off and adding fresh water, a stage is reached at which part of the clay precipitates in a flocculent mass; when adding more caustic soda to the solution proper suspension again takes place.

MR. CARTWRIGHT asked whether hydrogen was responsible for the presence of blow-holes which were not due to faulty venting. Particular difficulty was often experienced when casting in steel with a high chromium content. Was this due to hydrogen, and if so was the release of hydrogen caused by water in the ladle or, according to a more recent hypothesis, to electrolysis? He wondered whether other members had encountered the blow-holes he had referred to in low chromium steel.

DR. MARAIS said that it was found by experience that hydrogen was one of the most persistent contaminating elements in steel. It had actually been traced to humidity in the air, which during the operation of blast furnaces entered as hydrogen into the iron. This hydrogen persisted right through the steel-making process.

Core-Blowing Machines

MR. WARD told the meeting that through the assistance of Mr. Lion-Cachet, whose invitation given at the previous meeting of the Institute to Mr. Holdsworth and himself had been accepted, his company's "teething troubles" with core-blowing machines had been successfully solved.

TABLE I.—*Properties of Common Fuels.*

Solid fuels.	C	H	O	N	Ash	Moisture	Products of combustion.	
							Partial pressure.	Dew point.
							Lb. per sq. in.	Deg. F.
Bituminous coal	75.6	4.8	5.8	1.5	10.0	2.3	0.466	78
Anthracite ..	80.2	2.7	2.4	0.9	11.4	2.4	0.272	62
Coke	82.9	—	—	—	13.8	3.8	0.078	29
Wood	45.9	6.0	38.5	—	0.5	9.1	0.91	99

Gaseous fuels.	CO_2	O_2	CO	H_2	N_2	CH_4	C_2H_4	Products of combustion.	
								Partial pressure.	Dew point.
								Lbs. per sq. in.	Deg. F.
Coke-oven gas ..	3.4	0.3	7.5	52.3	3.4	29.1	4.0	2.2	129.3
Blast-furnace gas	11.0	—	27.0	2.0	60.0	—	—	0.82	95.0
Producer gas .. (without steam injection)	3.0	—	29.0	6.0	60.5	1.5	—	0.32	67.0

Lend-Lease Materials

WHITE PAPER ISSUED

A White Paper issued last week sets out the Government's policy with regard to exports from this country and the distribution here of lend-lease material. The Government has given a pledge to the United States about the use of materials received by this country under the Lend-Lease Act, and has undertaken that they will not be sent abroad again to compete with U.S. exports. The White Paper points out that all materials which we obtain under the Lend-Lease Act are required for the prosecution of the war effort. This principle governs all questions of the distribution and use of such goods, and his Majesty's Government have taken, and will continue to take, action to secure that these goods are not in any case diverted to the furtherance of private interests. Lend-lease materials sent to this country have not been used for export, and every effort will be made in the future to ensure that they are not used for export, subject to the principle that, where complete physical segregation of lend-lease materials is impracticable, domestic consumption of the material in question shall be at least equal to the amounts received under lend-lease. No materials of a type the use of which is being restricted in the United States on the grounds of short supply, and of which we obtain supplies from the United States, either by payment or on lend-lease terms, will be used in exports with the exception of the following special cases:—(*a*) Material which is needed overseas in connection with supplies essential to the war effort for ourselves and our Allies, and which cannot be obtained from the United States; (*b*) small quantities of such materials needed as minor though essential components of exports which otherwise are composed of materials not in short supply in the United States; (*c*) repair parts for British machinery and plant now in use, and machinery and plant needed to complete installations now under construction, so long as they have already been contracted for. Steps have been taken to prevent the export (except to Empire and Allied territories) of such goods which do not come within the exception referred to in (*a*), (*b*) and (*c*) above. Materials similar to those being provided under lend-lease which are not in short supply in the United States will not be used for export in quantities greater than those which we ourselves produce or buy from any source.

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The American Metallurgical Scene—3

The Manganese Problem

Considerable attention is being devoted by American technologists and mining companies to the question of adequate supplies of manganese to the metallurgical industries. In this metal, which is an important strategic metal in American defence economics, the United States is not abundantly supplied, and in the past has had to depend largely on foreign sources. It is now sought to reduce this dependence on imports by conservation in the use of the metal and by the further exploitation of natural resources within the States. A reference to the conservation of ferro-manganese was made in THE FOUNDRY TRADE JOURNAL of July 31 last.

Conservation of Manganese

At the annual conference of open-hearth operators, held in Chicago recently, CHARLES H. HERTY initiated a discussion on the conservation of manganese. He pointed out that the consumer has an important role, for he must accept a lower manganese content in his steel. Overall consumption in the steel industry is 12½ lbs. of manganese per ton of steel produced, but a larger proportion is consumed in sheet steels, which specify 0.30 to 0.50 per cent. Mn, than in alloy grades which specify manganese up to 1.30 per cent. Therefore, a five-point drop in the manganese specification for sheet products will decrease the national consumption by 2 to 3 per cent.

Spiegel or silico-manganese instead of ferro-manganese is unsuitable for rimming steel under 0.15 per cent. carbon, but it is suitable for higher carbon killed or semi-killed grades. Spiegel can be added in the furnace in order to raise the residual manganese, thereby decreasing the ferro-manganese addition to the ladle. In this practice the temperature of the bath should be a little hotter and the steel has to be in the furnace longer than when using ferros; specific details must be adjusted to suit local conditions. Ferro-manganese can also be saved by adding as much as possible in the ladle and as little as possible in the furnace; in some shops 5 to 7 per cent. better recovery resulted from this change in practice. The amount of ladle addition can be increased to the point where the ladle analysis begins to show irregularity in manganese.

The use of high manganese pig-iron is helpful in producing high residual manganese, but the residual manganese depends a great deal upon the condition and volume of the slag. One cannot cut the slag volume too much when making high carbon steel, because of the danger of phosphorus reversion. High manganese rail scrap can be used in place of spiegel; however, this is seldom available, for scrap rails have a high value for re-rolling and for cupola melting into high-test cast irons.

Increased Exploitation

Developments in exploiting indigeneous manganese resources in the United States are reported from Arizona and South Dakota. The M. A. Hanna Company, Cleveland, Ohio, is considering the erection of a small pilot mill to experiment with methods of concentrating manganese ore from the Artillery Peak district in Arizona. The Bureau of Mines has already reported a large amount of low-grade manganese ore as available in the district, and exploitation awaits only the completion of a satisfactory and economic method of concentration. The Bureau has been conducting tests at Boulder City on 2,500 tons of this ore, seeking such a method. In South Dakota the Bureau is to construct immediately a manganese processing unit near Chamberlain, where the manganese deposits are known to be large, but the ore is low-grade and heretofore it has been impossible to process it on a commercial basis. When investigations started in this field, it was hoped that a simple screening system could be employed in concentrating the nodular ore, but Bureau officials have since reported that the material requires preliminary treatment. The processing plant now to be built is designed to eliminate the difficulty.

Renewed attention is also being given to manganese ore in Montana, where a rapid expansion in output was realised during the 1914-18 war. From a beginning of only 3,000 tons in 1916, Montana, in September, 1918, was delivering high-grade manganese ore at the rate of over 40,000 tons per month, or better than half of U.S. domestic consumption in that year. Apart from the Philipsburg deposits, which in 1916 yielded only a little over 3,000 tons of chemical and metallurgical manganese ore, and in 1918 127,415 tons of high-grade ore, the principal producing area is in Butte, where there is a large deposit of rhodochrosite, a carbonate of manganese with a translucent pastel pink colour. This is the only large deposit of pink manganese in the world. The Anaconda Copper Mining Company has been given a large contract to furnish roasted and nodulised high-grade manganese concentrates, and new plant has been installed to concentrate second-class pink manganese ores from the Butte mines. After the ores are concentrated, most of the impurities, such as zinc, lead, copper, sulphur, phosphorus, iron and silica will have been eliminated. The concentrates will then be roasted and nodulised, eliminating the carbon dioxide and grinding the concentrates to finer than 300 mesh. The concentrates will be stock-piled and used by the steel industry as required. It is claimed that these concentrates will assay higher in metallic manganese and lower in impurities than any other large quantity of manganese in the world.

Anglo-American Resources to Wage War

A combination of the resources of Great Britain and the United States for the prosecution of the war, quite apart from the huge resources possessed by the Allies outside Europe, excluding our new Ally, Russia, presents some formidable totals. They were referred to in an article written by Mr. Harry Hopkins, the chief administrator of the Lease-Lend programme, for an American magazine. He says:—

"British and American steel capacity is about 110,000,000 tons a year; the whole of German-controlled Europe cannot produce more than 42,000,000 tons a year. . . . Nickel steel is the easiest armament steel to make and use. We command 110,000 tons of nickel a year; the Germans 2,500 tons. Germany may now command up to 100,000 tons a year of chrome; we command 600,000 to 700,000 tons a year. Unless Germany gets tin by illicit means through leaks in the blockade, she should not be able to get more than 1,000 tons a year; we can command about 200,000 tons. The Allies and the U.S.A. together consume in three weeks as much copper as Germany is now able to obtain in a year. Only in aluminium is Germany and conquered Europe equal to the capacity of the Allies and the U.S.A. But she has to use aluminium as a substitute for other metals. Germany has no rubber except what is run through the blockade. The production of substitute rubber makes heavy demands on the German chemical industry, which is not immune to accidents and interferences. Nothing can conceal German concern about petroleum products, which we can command up to 200,000,000 tons a year. At best, Germany can get up to 15,000,000 tons a year, including her synthetic output. . . ."

Iron and Steel Production

Production of coke pig-iron in the United States in June totalled 4,553,165 net tons compared with 4,599,966 tons in May. Output on a daily basis showed a gain of 2.3 per cent. over that in May. The operating rate for the industry was 95.9 per cent. of capacity in June, compared with 93.8 per cent. in May. There were 211 furnaces in blast on July 1, as against 206 in blast on June 1. The furnaces in operation on July 1 were producing at the rate of 153,600 tons a day, compared with a production rate on June 1 of 151,000 tons.

Production for the first six months of this year was 27,053,100 net tons, against 21,083,600 tons in the comparable period last year. The daily rate averaged 149,465 net tons, a gain of 29 per cent. over the 115,844 tons in the same period last year.

The output of open-hearth, Bessemer and electric ingots was 6,800,730 net tons in June against 7,055,132 tons in May, the industry operating at 98.2 per cent. of capacity against 98.7 per cent. in May. Total output for the first six months of the year was 40,911,886 tons, as compared with 29,405,402 tons in the first half of 1940 and 68,981,662 tons for the whole of last year. In the six months, open-hearth output at 37,001,703 tons was estimated at 100 per cent. of capacity. Bessemer steel output at 2,587,748 tons averaged 74.5 per cent. of capacity, and electric steel output at 1,322,435 tons averaged 103.1 per cent. of capacity.

American Foundry Statistics

Foundries in the United States and Canada total 5,259, an increase of 26 from 5,233 in 1939, according to a survey by "The Foundry." In the United States the number is 4,812, up 36 from 4,776 in 1939, while Canada's total decreased 10, from 457 to 447. The number of grey-iron foundries in 1941 (and 1939) was 3,337 (3,394); steel foundries, 326 (327); electric steel foundries, 239 (239); malleable foundries, 155 (149); exclusive non-ferrous foundries, 1,531 (1,462); non-ferrous foundry departments of other shops, 1,561 (1,586); aluminium foundries, 2,424 (2,380); total non-ferrous foundries, 3,092 (3,048); machine-shop foundries, 3,222 (3,244); patternshop foundries, 3,235 (3,251).

The Machine in War

Wars to-day are largely won or lost in a nation's factories. Figures compiled by the U.S. National Machine Tool Builders' Association show that in Cæsar's time the soldiers themselves made practically everything they required in battle. Not until 1870 was there need of one man at home for each one fighting. By 1918, every man in the ranks had to be backed up by five men in factories. To-day the proportion is estimated at 18 to one. Compared with the last war, soldiers now fire a rifle three times as fast, travel ten times farther in a day, and have bombing planes with a range 32 times greater. This increasing emphasis on the man behind the firing line makes industry the primary battlefield. Unless he is adequately supported at home, the soldier might as well never take to the field.

Research in the United States

The United States must speed up its own research and make it more effective to compete with Germany's huge and efficient industrial research system, states Maurice Holland, director of the division of engineering and research of the National Research Council. In the United States the number of laboratories and research workers has increased sharply since 1920. The number of laboratories rose from 300 to 2,264 and workers from 9,000 to 70,063. Mr. Holland pointed out that industrial research in the United States now is entering the substitute or *ersatz* phase in which Germany has been working for 20 years. The war has shown, he said, that Germany's substitute materials are generally good. He termed the German research set up as the most highly integrated in the world. The defence programme has exercised far-reaching influences on industrial research. Fundamental or pure science research, with a few exceptions, has been laid aside and attention turned to the immediate problem of developing substitute materials to be used in defence armament.

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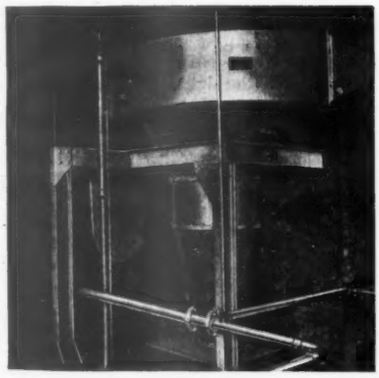

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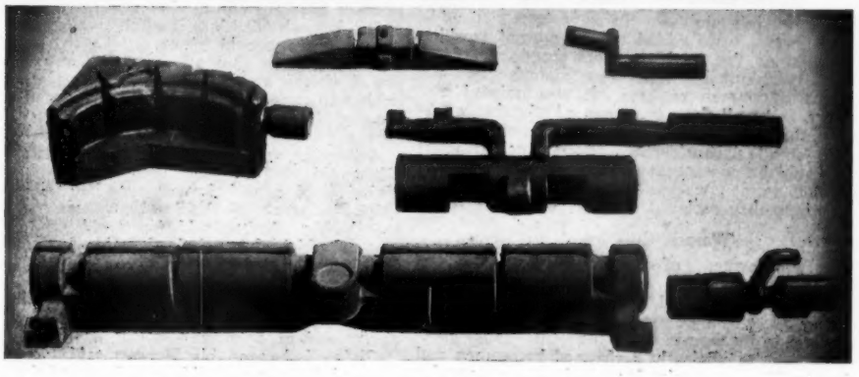

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Female Employment in German Foundries

Even before the war, Germany had mobilised women workers on a large scale in order to meet the tremendous labour requirements consequent upon the execution of the Four-Year Plan, recalls the "International Labour Review" in a survey of the employment of women in war industry. On August 15, 1939, the Ministry of Labour for the Reich declared that the number of women workers had increased by 18 per cent. during the last two years. By that time, they constituted nearly one-third of the total number of workers in employment. As a result of dislocations of employment which followed the outbreak of hostilities, the number of women at work decreased by 500,000 in the first months of war, the figure reaching its lowest point in January, 1940 (7,600,000). From then on, however, the employment of women has increased gradually. In August, 1940, the number of women at work exceeded by 300,000 the number in employment before the war. Since that month, the figure has not appreciably increased as the labour requirements of war industries have been met largely through the increasing employment of prisoners of war and foreign workers.

The increase in the number of women workers was accompanied by changes in the character of their employment. The decrease in male workers resulting from mobilisation led to the increasing employment of women in work which had previously been done by men. The proportion of women in the total labour force in employment has risen from 32.8 per cent. in the middle of 1939 to 39 per cent. in the middle of 1940, states "Die Deutsche Wirtschaft." This process of substitution has made it necessary to discover and to analyse the occupations in which women might be placed with advantage and the measures which might be taken to avoid difficulties arising from the employment of women workers. In Berlin-Brandenburg, for example, a series of lectures was held on the subject. Medical men employed in the plants gave talks describing occupations and processes which are, and owing to their character should be, forbidden to women, and then gave examples of work which can now easily be performed by them.

Unsuitable Work and Training

Work which demands constant physical effort, such as particularly heavy lifting, should not be entrusted to women. The limit for lifting and carrying is generally fixed at 15 kg. If tools must be used continually in any job, their weight should be examined and taken into account in connection with the employment of women on any such jobs. A drill gauge, for instance, which has to be lifted 1,000 to 1,500 times a day by a woman in a seated position should weigh less than 5 kg.

It was explained that the efforts to encourage the engagement and training of women for factory work would never have achieved the results which had already been obtained had it not been for the fact that construction and management engineers had helped to make it possible for newly trained female workers to perform operations previously entrusted to skilled male workers. Methods of work were changed, or a subdivision of operations was introduced after job analyses. In some instances, additional devices were added to the normal working machines, or the machines were reconstructed, or special machines and tools were manufactured for the use of women workers. It was pointed out, however, that all these measures of adapting working methods to the capacities of women workers would entail a considerable expenditure, but that this would be compensated, to some extent, by the fact that women workers were paid less than the men whom they replaced.

Women Coremakers

The employment of women in foundries has often been considered impossible or undesirable. Obviously, much of the actual foundry work is men's work, demanding a physical effort too great to be made by women. On the other hand, coremaking can be efficiently performed by women and offers a wide opportunity for substituting women for men in wartime. This substitution is subject, however, to limits with respect to the weight of the cores and the capacities of the women workers. As has been proved to be the case in many other branches of industry and work, women, because of their small hands and an often finer sensitivity in their fingertips, are particularly well adapted for the making of fine and complicated cores. For this reason foundries engaged in making complicated cores have employed women with success for many years. There are, of course, still further possibilities of employing women in auxiliary plants of foundries, in the bending of core wire (particularly when done by machines), for example, or in the fixing of core wires and in sorting iron scrap coming out of separators.

In pattern-makers' shops women can be employed for lacquering patterns. The sorting and testing of small castings in repetition foundries or small foundries, possibly the cleaning of small castings, particularly in light alloy foundries, can easily be done by women. They can also be employed in the delivery department and for the testing of serial goods. Women should not, as a rule, be employed in pattern-makers' shops and in pattern-smiths' shops or as crane drivers. It is considered that their health would be affected by the fumes and that the complete concentration necessary for the handling of ladles filled with liquid metal cannot be demanded of women.

Law Reports

Legal Notice for Foundry Manager

The question of reasonable notice for a manager in the foundry trade was one of the points which his Honour Judge A. C. Caporn decided in an action at the Walsall County Court.

Kenneth Cartwright Lythgoe, of Lichfield Road, Bloxwich, Walsall, claimed from Samuel Russell & Company, Limited, of Northcote Street, Walsall, £200 damages for wrongful dismissal. The plaintiff claimed that he was employed by the defendants as the general manager at a salary of £500 a year, paid monthly, and a bonus of £20, and that he was entitled to reasonable notice, which would not have been less than six months. By a letter dated July 10, 1941, the defendants, however, determined his employment by giving him a cheque for £62 10s., stating that that was in lieu of one month's notice.

Defendants did not admit that the plaintiff was employed as general manager, denied that he was entitled to any bonus, and said further that it was an express term of his employment that it should be determinable by one month's notice on either side.

Adam Kennedy Kirk, managing director of the defendant company, stated that at the first interview with the plaintiff he made it clear that the engagement was subject to one month's notice on either side. At the end of the six months' trial he was not particularly satisfied with the way Mr. Lythgoe had been doing his work, but he told him to carry on on the same basis. The month's notice was referred to on several subsequent occasions and plaintiff never demurred to it or suggested that he was entitled to longer notice. The £20 was a Christmas gift and not a bonus.

His Honour: You say that the plaintiff himself, at the first interview, mentioned a month's notice, and he asked that the terms of engagement should be put into writing, so that he would know where he stood. You put them in writing and you do not say anything about the month's notice. That seems inconsistent, does it not?

Witness: It would appear to be so, but in discussions such as that all sorts of items are raised and I always make it clear that engagements are subject to a month's notice. This was at the beginning of the war and things were not easy at that time.

Answering another question by his Honour, Mr. Kirk said no one had been appointed to take plaintiff's place and the turnover had increased.

In the course of the legal argument which followed, Mr. Tucker said he could not find any case in which the period of notice for a manager had been decided.

Subsequently his Honour remarked: "I should be sorry to think that in these times a place cannot be found in war work for a man of plaintiff's ability and experience."

Giving judgment, his Honour said plaintiff was engaged for a responsible position, and that it was known to the managing director that on the official notepaper of the company he described himself as general manager. The position in law appeared to be clear and that in the absence of any express agreement for a fixed period of notice, the plaintiff was entitled to reasonable notice, and Mr. Kirk had not satisfied him that it was mutually agreed that the employment should be subject to one month's notice. He had, therefore, to decide what was reasonable notice, and he had come to the conclusion that that would be three months from the end of July last. As the cheque received by the plaintiff covered his salary for about a month and a half, he was entitled to approximately two and a half months' salary, and there would be judgment for him for £102 with costs.

Location of Works Disclosed

An engineering firm was summoned at Leeds last week for publishing the location of certain works.

Mr. G. Goodhart, who prosecuted, said the proceedings had been brought under the Defence Regulations, which provide that nobody shall publish any information which might be useful to an enemy. The defendant firm had the highest reputation. The firm sent out a brochure to a customer in Cork, and it was stopped by the Censor. In the brochure, under the heading of "Aircraft Work, General," was a list of the firm's customers. By publishing that brochure the firm revealed a number of new shadow factories and new firms that were not generally known to be engaged on aircraft.

Mr. Harold E. Thackray (for the defendants) said the firm was of the highest standing, and doing work of national importance. They would not wittingly commit an offence, and he would like to point out that every one of the firms whose names appeared had had copies sent to them and they had not objected. One of the names mentioned was that of a research department of the Air Ministry, and one would have expected them to be the first to complain, as the circular had been in existence 12 to 18 months. A copy had also gone to the Ministry of Supply, though the Ministry's name did not appear on the circular. The circular would be withdrawn immediately.

The magistrate said he could not help thinking that a firm dealing with a department of the Air Ministry would be encouraged to think there was no harm in the circular if nothing was done by the Air Ministry. That being so, he would dismiss the summons on payment of 4s. costs.

New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

J. Brittain & Son (Engineers), Dragon Square, Chesterton, Staffs—£1,000.

Metal & Alloys Smelting Works—£500. H. I. Jacobs, 2, Stoke Newington High Street, London, N.16.

Studex Engineering Products—£2,000. R. T. Stuart and G. Dexter, 70, Manor Drive, Ewell, Surrey.

Midland Heat Treatments—£5,000. E. V. Hainsworth, 24, Richmond Road, Wolverhampton, subscriber.

Joselin & Farr, 55, High Street, Sutton, Surrey—Engineers, etc. £1,000. G. S. Lane, F. B. Frost, and C. G. King.

Spencer & Thwaite—Engineers and founders. £2,000. H. Spencer and S. Thwaite, Brookfoot, Brighouse, Yorks.

Farmer & Son, Coventry—General engineers. £10,000. W. M. Maddocks, 45, Woodland Avenue, Coventry, subscriber.

Lye Trading Company—Engineers, ironfounders, etc. £20,000. F. and F. C. Kitson, Norton Road, Iverley, Stourbridge.

Lloyd, Pascal & Company, 71-74, Ford Street, Birmingham, 18—Brass, bronze and iron founders, etc. C. E. Pascal and P. Lloyd.

Redhill Engineering Company—£1,000. J. B. Tipton and F. E. Elseley, Tollgate Bungalow, Woodhatch Road, Redhill, Surrey.

Wilson Deck Machinery—Marine and general engineers—£1,000. J. A. Page, Haworth, West Hill, Sanderstead, Surrey, subscriber.

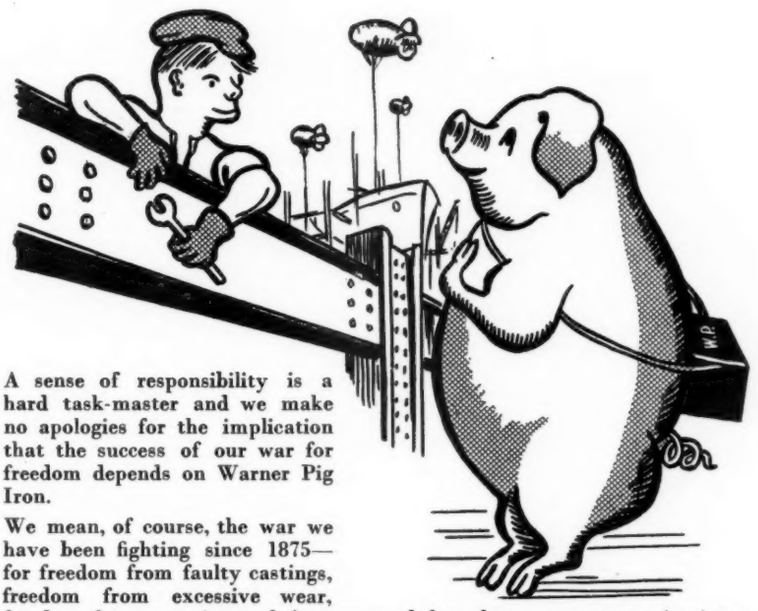
S. T. Coburn & Son—Ironfounders, engineers' merchants, etc. £1,000. S. T. and E. R. Coburn, 13, Hillwood Road, Hatch End, Middlesex.

Universal Welding & Engineering Company—£2,000. G. H. Betts and A. C. Longhurst, E. F. Gillson, 33, Connaught Street, London, W.2, subscriber.

Industries Accessories—Manufacturers of and dealers in dies, castings, tools, etc. £2,000. S. P. Richard, 60, Mountstuart Square, Cardiff: J. C. Clay, P. Freeman, and A. J. Cruise.

W

"It all depends on me"



A sense of responsibility is a hard task-master and we make no apologies for the implication that the success of our war for freedom depends on Warner Pig Iron.

We mean, of course, the war we have been fighting since 1875—for freedom from faulty castings, freedom from excessive wear, freedom from porosity and from every defect that can scrap an intricate and expensive casting.

During all these years many of the most progressive Foundries have depended on Warner Pig Iron and an ever-increasing number depend on it to-day to meet new problems and even more stringent specifications.

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Warner's

Special Pig Irons

WARNER AND CO. LTD., CARGO FLEET, MIDDLESBROUGH

W

The Week's News in Brief

Trade Talk

AVELING-BARFORD, LIMITED, have issued 15,000 £1 5½ per cent. cumulative preference shares, which brings the issued amount up to the authorised total of £175,000.

AN INTERNATIONAL CONFERENCE on "Science and World Order" will be held under the auspices of the British Association on September 26, 27 and 28, at the Royal Institution, London. Sir Harold Hartley will be dealing with "Power" and how the natural resources of the world can be developed to secure the maximum benefit and open up new possibilities.

OWING TO THE NATURE of their work, employees in various industries find the number of clothing coupons normally issued inadequate. As a result underground workers in the mining industry are to be given extra coupons. Negotiations are proceeding with a view to securing additional coupons also for workers in the iron and steel industry, including men working at foundries, coke ovens and blast furnaces, and chain makers and strikers.

IN THE HOUSE OF COMMONS, the Chancellor of the Exchequer asked if he was aware that many companies were making munitions, or other wartime necessities, which were not authorised by their memoranda of association, and whether he would introduce legislation to rectify this position, replied that he was aware that difficulties might be felt on this score. If any company felt in doubt, it should approach the Government Department concerned with its production, he said, for powers existed to deal with the situation under the Defence Regulations, and there appeared to be no need for further legislation.

FOR THE MORE EFFICIENT co-ordination of their surplus plant and equipment for war production, six of the most important engineering and foundry companies on the Rand have formed a non-profit making company—"Co-ordinated Engineers (Pty.), Limited." It is believed that if the surplus equipment and resources of each of the six companies are controlled as one unit instead of as heretofore being treated as six separate units, considerable advantages would result. This interesting experiment, in co-operation for war purposes, is being regarded with great interest by the authorities who have expressed their desire to utilise the organisation to the full. The six companies concerned are: Wright, Boag & Company, Limited; East Rand Engineering Company, Limited; Standard Brass, Iron & Steel Foundries, Limited; Austral Iron Works, Limited; Central Engineering Works, Limited; and Rowe, Jewell & Company, Limited.

ARRANGEMENTS for providing higher grade courses at Government training centres, technical colleges and in industrial establishments where the equipment and instructors are available are now to be developed to the fullest possible extent, states the Ministry of Labour. The training up of experienced workpeople to a higher degree of skill than that which they possess is regarded as one of the most valuable forms of training which the Department can undertake to assist employers. Under this scheme the employer can get his skilled operatives trained to a higher degree free of charge. The operatives remain on the employer's pay-roll during training and return to their employers afterwards. In appropriate cases the Ministry is prepared to provide some financial assistance to meet the expenses which the employer may incur owing to the man's absence, and to arrange for trainees from Government training centres to take the place of men undergoing training.

SPEAKING AT A MEETING at Jarrow recently of the North-Eastern Section of the Institution of Production Engineers, of which he is president, Mr. W. A. Harriman, a director of A. Reyrolle & Company, Limited, manufacturing electrical engineers, Hebburn, Co. Durham, expressed the view that the gravitation of industries from the North-East area was due largely to the better production organisation and technique available in other districts. After referring to the range of engineering inventions for which Tyneside in particular was famous, Mr. Harriman said it was interesting to consider the large number of light industries which had been started in the Tyneside area and had gravitated to the more advanced production centres, and asked if it did not show a neglect of production technique. Production engineering meant that it aimed always at producing goods in the best and the cheapest possible manner, always by scientific methods and not by undercutting rates of pay or wages. He felt that the lack of this production mentality was one of the causes why we could not compete in the world markets during the depression preceding the war. The science of production engineering could help the country at present, but the greater benefit would be felt when the world's markets were once more happily open for international commerce.

Personal

MR. CHARLES WILLIAM COLEMAN, so well-known internationally in the foundry industry as a moulding machine and general foundry expert, is retiring from the foundry equipment business in the near future. He has sold the Coleman Foundry Equipment Company, Limited, Windsor Works, Stotfold, Beds to Mr. Andersen and Mr. Hartmann. The aims of the new proprietors are to preserve and enhance the reputation the company enjoys for giving practical service to the users of its machines. Mr. Coleman is the oldest moulding machine expert to-day, and imported the first mechanically-operated moulding machine into Britain, and for 31 years was sales manager of an American firm of moulding machine manufacturers. He has been managing director of the Coleman Foundry Equipment Company, Limited, for 15 years and still has other business interests. Mr. Coleman wishes us to say that he regrets he will not have so many opportunities of meeting old friends in the foundry world, but at his private address—Orchard, Norton, Letchworth—he will at any time be very pleased to hear from them. The good wishes of the whole of the foundry industry will go to Mr. Coleman on this occasion. Many will regret that there will be fewer chances of the thrill of being driven by Mr. Coleman to visit some of the installations he has made.

Wills

SHARP, C., for forty years a director of the British Oxygen Company, Limited	£58,642
HAVENHAND, W. H., of Sheffield, works manager of W. A. Tyzack & Company, Limited, steel and tool manufacturers	£18,922

Obituary

LT.-COL. A. G. SCAMMELL, managing director of Scammell Lorries, Limited, died at St. Albans on September 4, aged 63.

MR. HARRY HARDWICK died at Sheffield on September 2, aged 63. He was the proprietor of a brassfoundry in Matilda Street, Sheffield, which he established 43 years ago.

MR. THOMAS IRVING, who retired last March from the position of works manager and director of Douglass Bros., Limited, Globe Ironworks, Blaydon-on-Tyne, has died at the age of 67 years. He was 52 years with the firm.

MR. GIDEON M. BILLINGTON, director of Billington & Newton, Limited, metal manufacturers and founders, Longport, North Staffs, died recently at the age of 72. He was actively engaged in the business until about a year ago.

MR. ROBERT HASWELL, managing director of William Doxford & Sons, Limited, shipbuilders and engineers, Pallion Yard, Sunderland, died on September 9. He was 76 years of age and had been connected with the firm for 63 years.

MR. GEORGE WILLIAMS, of Cradley Heath, who for more than 25 years had been secretary of the Chain Manufacturers' Association, has died in tragic circumstances. Mr. Williams was struck by a motor-car and instantly killed.

MR. SAM SMITH, managing director of Samuel Smith & Sons, Limited, Beehive Foundry, Smethwick, died on September 5. Mr. Smith took an active interest in public affairs, and served as Mayor of Smethwick for two years in succession (1929-31).

MR. HENRY A. GREEN, managing director of Murex, Limited, died recently. He was associated with the company for over 30 years and its success is in a large measure due to him. He was a pioneer in welding and conducted some most valuable practical researches.

New Board of Trade Orders

Two new Orders issued by the Board of Trade deal with the control of the manufacture of hollow-ware and the regulation of supplies of iron and steel to the Colonies through import licences.

Hollow-Ware to be Standardised

The Hollow-ware (Control of Manufacture) Order, 1941, has been formulated with the object of effecting economy in the use of labour and materials by standardisation in manufacture of hollow-ware in general demand, principally for domestic purposes. The hollow-ware affected includes such articles as pots, pans, pails, cans, kettles, buckets and bins of all kinds made from iron or steel whether galvanised, japanned, enamelled or treated in any way. Standardisation is not expected to make fewer goods available to the public. On the contrary, by eliminating a number of sizes and shapes, standardisation should make possible manufacture of larger quantities of goods from given amounts of material.

The Order, which comes into effect on September 24, forbids, except under licence, manufacture, by manufacturers who are on the Home Trade Register, Class 9, of the Limitation of Supplies (Misc.) (No. 11) Order, 1941, of hollow-ware made wholly or mainly of iron or steel. Manufacturers who are not registered under that Order do not require a licence. Licences must be applied for immediately from the Board of Trade, Industrial Supplies Department, Millbank, London, S.W.1. A catalogue or list of all hollow-ware which is being manufactured at the present date must be submitted with the application. An out-of-date catalogue may be used for this purpose provided that the sizes and types of hollow-ware being manufactured to-day are clearly indicated. Directions as to manufacture will be given from time to time. It is anticipated that with the assistance of the trade the supply of essential hollow-ware, subject to the quotas imposed by the Limitation of Supplies Orders, should be more economically and satisfactorily maintained.

Colonial Iron and Steel Requirements

The Board also announces that all Colonial commercial requirements of standardised iron and steel products (such as come within the scope of the First Schedule of the Control of Iron and Steel (No. 15) Order, 1941), which are submitted to Colonial Governments for the purpose of obtaining a Colonial import licence, will, if approved by the local authorities, be taken on Government account, and arrangements for supply will be made direct by the local Governments through the Colonial Supply Liaison in the United States.

Provisional licences will continue to be issued in the Colonial territories for supplies of such specialised products as cannot be obtained in the United States. Examples of such products are:—(1) Repair parts for British locomotives, machinery, etc., now in use; (2) special castings; (3) British standard screws, nuts, bolts, etc., in so far as no alternative products from the United States may be suitable. Orders for these will, for the present, continue to be placed through commercial channels in the United Kingdom. Applications should be sent to the Colonial Office, Whitehall, London, S.W.1, and should quote the number of the Colonial Import Licence. Envelopes should be marked "Iron and Steel Supplies." If it is thought that supplies could in fact be obtained from the United States, the applicants will be informed of the steps they should take.

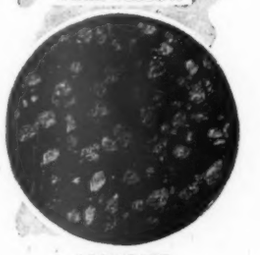
Firms having outstanding orders for which Colonial Import Licences were granted before September 1 should submit their applications through the Colonial Office with as little delay as possible in accordance with the procedure at present in force, for supply from the United States or the United Kingdom. These arrangements in no way affect the shipment of any orders already authorised by the Board of Trade.

Foundry Labourers Reserved

Among further changes in the schedule of reserved occupations and protected work, announced on Monday by the Ministry of Labour and National Service, is the inclusion of foundry labourers (general hands, iron and steel). These men who were not previously reserved now become reserved at 35.

CHELFORD

YORX YELLOW



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BASIC BRICKS: *Spinella, Saxpyre, Supermag, Diazite, Dolomax.*
ACID-PROOF REFRACTORIES: *Obsidianite, Losol.*

INSULATION: *Amberlite* Bricks, Cement and Concrete.
SILICA BRICKS: *Lowood, Meltham, Allen, Quartex.*
CEMENTS: *Sintex, Durax, Pyrolyte.* PLASTICS: *Durax, Rotaline, Plastic K-N., Glendoline, Ground Ganister, Steel Moulders' Compositions.* SILLIMANITE: Tank Blocks, Bricks and Cements. SANDS: Moulding, Brick Facing, Silica, Glass.

Raw Material Markets

The requirements of the shipbuilding and other trades utilising the products of the heavy-castings manufacturers are substantial and sufficient to keep the producing works employed to capacity. It is not possible to supply all the hematite and low-phosphorus iron wanted by the foundries, which are using considerable quantities of high-phosphorus and refined irons in their mixtures, together with a proportion of scrap metal. Hematite is particularly difficult to acquire, as the Control authorities will only distribute supplies for work of the highest priority and when hematite is essential for the nature of the work in hand. Light-castings makers, on the other hand, are in no way troubled by lack of material, ample supplies of high-phosphorus iron being despatched to them. The volume of business which the works are able to obtain is still inadequate to permit the full use to be made of productive capacity.

Pig-Iron

MIDDLESBROUGH—In view of the fact that North-East Coast ironworkers are entirely devoted to the production of material for the steel industry there is no likelihood of any resumption being made of the manufacture of Cleveland foundry iron. For a long time buyers of foundry qualities have purchased their supplies in the Midlands and satisfactory deliveries have been made from this quarter, at prices corresponding to those invoiced for iron produced locally. Heavy foundries have as much work as they can accommodate, but there is room for a considerable expansion of operations in the light foundry trade.

Every economy in the use of hematite is encouraged and there is no doubt that gratifying cuts have been made in the amount of this type of iron required by consumers. There is difficulty in procuring the necessary ores for the hematite furnaces, as they have to be brought from the West Coast or, alternatively, imported, this in either case making a call on transport facilities. Thus, only really essential demands for hematite are licensed. Refined iron is in increased demand, while ferro-manganese is absorbed as it becomes available.

LANCASHIRE—A slight improvement is to be noted in the position of the light-castings trade, but, generally, this branch is poorly situated and is able to give prompt attention to any business which materialises. Many firms have stocks of iron on hand, so that there is less pressure for further supplies. Most jobbing foundries are only moderately engaged, although there has lately been a small expansion in the volume of orders placed in this section. Brisk conditions are ruling in the heavy engineering industry, where heavy electrical engineers, machine-tool works, etc., are in possession of well-filled order-books. A considerable amount of important work is being fulfilled by these concerns.

MIDLANDS—With full-scale operations persisting at all heavy engineering establishments in this area, there is little relaxation in the demand for hematite and low-phosphorus irons, although only a proportion of the applications for licences can be granted. Consumers, however, have been able to obtain satisfactory results from the use of high-phosphorus and refined irons and steel scrap, which have been incorporated in furnace mixtures for months past. There is some apprehension regarding future supplies of steel scrap, but at present quite good deliveries are being made. Dull conditions continue to be reported at most of the light-castings foundries, and prospects of there being any material improvement during the period of hostilities are remote. The building industry is only making moderate demands for castings, while the loss of the export market is still severely felt by makers.

SCOTLAND—Foundries are getting only just sufficient iron to permit continuous working, and no opportunity has presented itself for the accumulation of reserves. Consumption is heavy and users are actively employed on urgent contracts for various Government departments and other important buyers. The Falkirk and district light-castings industry is still mainly engaged at well below capacity levels, and there is little reason to expect a quickening in the call for light castings in the early future, as there is not much scope for placing these products in ventures associated with the war effort. Basic iron is well taken up by steelworks, but the supply is satisfactory.

Coke

Foundry-coke producers in all areas are supplying consumers with adequate deliveries, and the position is very healthy, many users already having appreciable stocks on the ground. Quotations are officially controlled, the present price of Durham best coke being 62s. 9d. per ton, delivered Birmingham and Black Country stations, and 46s. 9d., f.o.t. ovens.

Steel

Steelmakers are now, more than ever, operating in the interests of the national effort, unimportant civil business being completely ruled out. In this way producers are enabled to forge ahead on the many commitments which they have on Government account unhindered and with the knowledge that every ton of steel produced is a definite contribution to the war effort. The quickening tempo of arms production is calling for substantially increased tonnages of alloy steels, with the result that output of these descriptions is being enlarged at the expense of other grades utilised mainly for less important work. Makers of steel plates continue to report full order-books, and there is no sign of any falling away in the demand from the ship-building, boiler, tank, wagon and other industries which use plates on a broad scale. Structural steel, however, particularly heavy joists, is still inclined to be quiet.

Scrap

While deliveries of most sorts of scrap iron and steel are satisfactory at this juncture, the authorities are emphasising the vital necessity for continuing at full strength the search for fresh material, which is likely to be all the more in demand in view of the reduction in imports of American scrap. Steelmakers are especially keen to see further tonnages of home-produced metal brought out. Damaged buildings have already made a big contribution to the scrap campaign, and if it might seem that demolition scrap is allowed to remain for long periods on the scene of destruction, it is generally due less to negligence on the part of the authorities than to difficulties of collection and distribution.

Metals

COPPER—The Control is meeting without apparent difficulty the requirements of the armaments works and the munitions makers, and that the supply position is satisfactory is gratifying in view of the high level of consumption which must now have been reached. Still more copper will be required, especially if it is decided to send metal to Russia. The American copper position is undoubtedly still on the tight side, and deliveries to the consuming works could be improved were additional metal available. The assistance which the United States might be able to render to the Soviet Union in the matter of copper will be dictated by the extent to which the supply position can be improved. It is estimated that American priority needs of copper during the present month will be at around 140,000 short tons, with ordinary civil requirements accounting for an additional 50,000 tons, whereas available supplies are not expected to amount to more than about 131,000 tons. Russia will certainly have to seek copper outside her own borders, and a part of the output of the British Empire and the Belgian Congo is likely to be made available for our Allies, despite the heavy demands already made on our own resources.

TIN—That Malaya is contributing largely in the British efforts to despatch war materials to Russia is revealed in the statistics of Malaya's foreign trade for July, which have just come to hand. Russia, which for years received no exports from Malaya, became during July last the third largest recipient of Malaya's exports, including tin and rubber, receiving nearly £1,000,000 worth. There has again been rather more activity on the London market this week, there being a good demand for forward metal especially. These more active conditions probably resulted from the expectation that further supplies of tin will be shipped to Russia from the East. Demand for tin is heavy, but here, as in the United States, much of the metal delivered is being placed to stock. The restrictions on the use of tinplate have released a considerable amount of tin for other purposes.

The International Tin Committee met on Tuesday. Satisfactory progress was made in discussion of the new draft agreement for tin control, it is stated, and the delegates unanimously agreed to refer recommendations on certain points to their respective Governments.

Tin prices on the London Metal Exchange during the past week have been as follow:—

Cash—Thursday, £256 10s. to £256 15s.; Friday, £256 5s. to £256 10s.; Monday, £257 to £257 5s.; Tuesday, £256 15s. to £257; Wednesday, £256 10s. to £256 15s.

Three Months—Thursday, £259 10s. to £259 15s.; Friday, £259 10s. to £259 15s.; Monday, £259 15s. to £260; Tuesday, £259 10s. to £260; Wednesday, £259 10s. to £259 15s.

SPELTER—Consumption of spelter in the United Kingdom remains at a high level. With the sheet mills less active, requirements for galvanising have been reduced, but the amount of metal going into armaments and munitions manufacture is very large indeed. Our needs will be greater if we supply this metal to our Russian allies and, all told, there is little prospect of very much more metal than is at present being released going into non-essential employment.

The American Office of Production Management has announced that the Metals Reserve Company is financing plans, which have been approved, for the expansion of zinc-smelting capacity at the Moundsville, W. Va., plant of the United Zinc Smelting Company. The increase in the capacity is likely to be from about 11,500 tons to 25,000 tons per annum. Still further evidence of the efforts now being made in the United States to economise in the use of zinc is contained in a report which states that the motor trade for its 1942 models will require approximately 18.6 lbs. of zinc per car; this compares with a normal average content of around 45 lbs. Motor-car production will, moreover, be reduced by 50 per cent.

LEAD—Virgin lead supplies are ample to satisfy the needs of the war machine and the moderate demands from other sources, and there is no cause for apprehension regarding the future, although no liberties are allowed in the distribution of the metal, which, like other non-ferrous metals, with the exception of tin, is in the hands of the Non-ferrous Metals Control. There has recently been a falling away of the volume of scrap lead offered, supplies of demolition metal and battery plates scrap, especially, having been reduced.

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